

REMARKS

Applicants acknowledge that this application is currently under final rejection. However, the revisions made to the claim language by the foregoing amendment (principally Claims 17 and 18) are directed to matters of form, and do not significantly affect the scope of the claims. Such revisions do not raise any new issues, or require further analysis or search. Accordingly, Applicants respectfully submit that the foregoing amendment is entitled to be entered. In the event that the Examiner determines that the submission of this response does not place this application in condition for allowance, entry of the foregoing amendments is requested in order to place the claims in this application in better form for appeal.

Claims 11 and 13-19 have been rejected under 35 U.S.C. § 112, second paragraph for failing to particularly point out and distinctly claim the invention, based on a formal issue cited in item 1 of the Office Action. In particular, the Office Action refers to Claim 11, line 9, questioning how the layers penetrate each other. In response to this ground of rejection, Applicants refer to the specification at paragraphs [0008] and [0027], as well as Figures 1a and 1b of the drawings. Figure 1a in particular shows the respective layers 1a and 1b, each of which includes bundles 11 of fibers 10, which extend in the Y and X directions, respectively. Figure 1b, on the other hand, shows the third layer 1c, which extends in the Z direction, and penetrates through the openings or spaces

between the bundles which form the layers 1a and 1b. The penultimate paragraph of Claim 11 clearly refers to each of the first, second and third layers of fibers or bundles of fiber, as depicted in Figure 1b, extending in the three orthogonal directions X, Y and Z.

Applicants note that the last paragraph of Claim 11 recites that the step of forming the first, second and third layers includes separating the fibers or bundles of fibers of the respective layers from each other, such that in each layer, fibers or bundles of fibers of another layer can be disposed in the resulting spaces, as clearly shown in Figure 1b. Accordingly, Applicants respectfully submit that Claim 11 is clear and definite. Nevertheless, if the Examiner continues to believe that Claim 11 is ambiguous, further clarification of this ground of rejection is respectfully requested.

Claims 23-26 and 30 have also been rejected under 35 U.S.C. § 112, second paragraph, item 2 of the Office Action questioning how feeding the silicon into the fiber structure makes a "silicon carbide matrix". In response to this ground of rejection, Applicants refer to the specification at paragraphs [0011] and [0027], in which the process by which the formation of the silicon carbide matrix is explained. In particular, [0011] states that the silicon carbide can be formed through a reaction of silicon with the fiber structure. Similarly, paragraph [0027] says that the fiber structure is produced in the form of a three

dimensional matrix made of carbon fibers, which is “infiltrated with silicon, forming a silicon-carbide containing composite material”. Accordingly, Applicants respectfully submit that Claims 23-26 and 30 are clear and definite as well.

Claims 11-14, 21 and 24 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Strasser et al (U.S. Patent No. 6,134,881) in view of Haidn et al (U.S. Patent No. 6,151,887), while Claims 17-20, 22, 23 and 25-29 have been rejected as unpatentable over Strasser et al in view of Tuffias et al (U.S. Patent No. 5,855,828). However, for the reasons set forth hereinafter, Applicants respectfully submit that all claims which remain of record distinguish over the cited references, whether considered separately or in combination. Applicants note in this regard, that Claims 12 and 20-22 have been cancelled, and accordingly are not addressed further herein.

With regard to the rejection of Claims 11-14 over Strasser et al and Haidn et al, Applicants respectfully submit that at least the following steps which are recited in Claim 11 are neither taught nor suggested by either reference:

“said producing step comprises forming first, second and third layers of fibers or bundles of fibers, wherein fibers of said first layer extend in a first direction in space; fibers of said second layer extend in a second direction in space; and fibers of

said third layer extend in a third direction in space; and wherein
said first, second, and third layers penetrate each other at least
partially; and

said forming of first, second and third layers includes
separating said fibers or bundles of fibers of the respective layers
from each other such that in each layer, fibers or bundles of
fibers of another layer can be disposed in resulting spaces”.

In particular, while Strasser et al discloses a port liner having a three dimensional tube shaped structure (Column 3, lines 26-28), it contains no disclosure which suggests that either of the inner or outer walls, which are formed of a fiber reinforced ceramic matrix composite material, has a structure comprising first, second and third layers of bundles of fibers extending in first, second and third directions in space, respectively, and penetrating each other at least partially, as recited in the claims. Furthermore, the fabrication process in Strasser et al, which is described at Column 9, line 8 through Column 12, line 54, does not include a step of forming such first, second and third layers (as described) by separating the fibers or bundles of fibers of the respective layers from each other, such that in each layer, the fibers or bundles of fibers of another layer can be disposed in the resulting spaces.

Applicants acknowledge that, as noted in item 6 of the Office Action, the Patent Office frequently takes the position that structural limitations in process claims are not limiting, and need not be taken into account. Nevertheless, in this instance, Applicants respectfully submit that in the context of Claim 11, the step of producing a ceramic matrix composite by forming first, second and third layers in the spatial relationships described, does in fact constitute a valid limitation of the step of "forming". That is, any step of "forming" is necessarily limited by the specification of that which the step forms. (A step of "forming" a sphere, for example, differs from a step of "forming" a rod.) Otherwise, a step of "forming" would have no meaning.

Moreover, the last paragraph of Claim 11 recites a step of "separating said fibers or bundles of fibers of the respective layers from each other". The latter step is also clearly limiting, and cannot be ignored. Neither of these limitations is taught or suggested in the Strasser et al patent.

The Haidn et al patent, on the other hand, is directed to a combustion chamber for a rocket engine, which includes inner and outer shells, the outer shell being formed of a fibrous ceramic material and the inner shell being formed of a fibrous ceramic material or from graphite. (See Column 2, lines 35-39, Column 3, lines 27-29.) While Haidn et al states at Column 11, lines 51 to 53, that the fibrous structure can be built up using three-dimensional weaving

and/or braiding techniques, nowhere does it teach or suggest the specific process steps defined in the last two paragraphs of Claim 11, as described above. In fact, Haidn et al contains no explanation at all regarding the particular steps by which the fibrous structure is formed.

Claim 24 has also been rejected as unpatentable over Strasser et al in view of Haidn et al. However, Applicants note that Claim 24 depends from Claim 23, which recites a step of providing an intermediate layer between the external jacket and the composite material jacket which intermediate layer has a thermal expansion coefficient which is between that of the external jacket and that of the composite material jacket. Insofar as Applicants have been able to determine, that feature of the invention is neither taught nor suggested by either of Haidn et al or Strasser et al. Accordingly, Applicants respectfully submit that Claim 24 distinguishes over both references.

With regard to the rejection of Claims 17-20, 22, 23 and 25-29 as unpatentable over Strasser et al in view of Tuffias et al, Applicants note that Claims 17 through 19 depend from Claim 11, and are therefore allowable for the reasons articulated previously. (Claims 20 and 22 have been cancelled.) However, to the extent that these claims have been rejected over Strasser et al in view of Tuffias et al, Applicants respectfully submit that they distinguish for the further reasons set forth hereinbelow.

Tuffias et al discloses a refractory composite structure which has a roughened dendritic surface, and is produced by chemical vapor deposition, as noted in the Abstract. In particular, Tuffias et al provides a composite structure 18 which includes a noble metal layer 20 and a refractory metal layer 22 that are bonded metallurgically through an interface 24. The interface 24 in turn is formed by a gradual transition from one metal to a mixture of the metals to the other metal, without discontinuities, as indicated at Column 9, lines 48-51.

Claims 17 through 19 of the present application are directed to an embodiment of the invention which further comprises channel-shaped spaces formed on or in the fibrous structure. Claim 17 recites that a metal coating is applied to the surface areas of the composite material that have the channel-shaped spaces. (Claim 18 is similar, but depends from Claim 16, rather than Claim 15.) Finally, Claim 9 further recites a step of arranging channel-shaped contracting bodies on or in the fibrous structure. The latter features of the invention are neither taught nor suggested in either Strasser et al or Tuffias et al.

Furthermore, Claim 23 is directed to an embodiment of the invention, referred to previously, which includes the step of providing an intermediate layer between the external jacket and the composite material jacket, which intermediate layer has a thermal co-expansion coefficient that is between that of

the external jacket and that of the composite material jacket. The latter feature of the invention is also neither taught nor suggested in either of Strasser et al or Tuffias et al. It is noteworthy in this regard that the intermediate layer 28 in Strasser et al is disclosed as potentially comprising materials such as "ceramic powder, ceramic foam, dry fibers, diatomaceous earth, or other high-temperature capable insulating materials". (Column 6, lines 24-26.) The essential feature of such materials is that they are good thermal insulators. The Strasser et al reference contains no discussion at all regarding the coefficient of thermal expansion of any such materials as might be used for the intermediate layer. Tuffias et al, on the other hand, contains no such intermediate layer. Since Claims 25 depends on Claim 23, while Claim 26 depends on Claim 24, which in turn depends on Claim 23, Claims 25 and 26 distinguish over the cited references for the reason reasons.

Claims 27-29 define a process for manufacturing an intermediate layer between and internal jacket and an external jacket of a combustion chamber for a rocket drive, including the steps of affixing a fibrous structure made of carbon containing fibers on the internal jacket and depositing a metal material on the fibrous structure, with simultaneously infiltration of the fibrous structure with the metal material. Finally, Claim 27 recites that at least one part of the internal jacket or of the external jacket is made of a composite material with fibrous structure carbon containing fibers.

In Tuffias et al, the carbon containing composite is formed by preparing a preform or construct of carbon fibers, which is subsequently infiltrated by a carbon matrix precursor, such as a resin, as described at Column 7, line 66 through Column 8, line 6. None of the layers 32, 20, 24, 22, 28 or 30 of the Tuffias et al, however, is made of a composite material with fibrous structure of carbon containing fibers. (See, for example, Column 5, line 38 through Column 10, line 3.) Claim 27 requires that at least one part of the internal jacket or external jacket be made of composite material with fibrous structure of carbon containing fibers. Accordingly, Tuffias neither teaches nor suggests the specific process defined in Claims 27 through 29.

In light of the foregoing remarks, this application should be in condition for allowance, and early passage of this case to issue is respectfully requested. If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and

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please charge any deficiency in fees or credit any overpayments to Deposit
Account No. 05-1323 (Docket #010739.51198D1).

Respectfully submitted,

A handwritten signature in cursive script, reading "Gary R. Edwards", written over a horizontal line.

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